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10.15343/0104-7809.202347e12792022I

Prevention of catheter-associated infection: effect of an intervention on the knowledge of intensivists

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Abstract

Urinary tract infection is one of the most common problems during health care, especially in the intensive care unit, and is mostly associated with the use of a urinary catheter, contributing significantly to mortality, morbidity, and the cost of treatment. The objective of this study was to evaluate the effect of an educational intervention on the knowledge of intensive care professionals upon measures to prevent urinary tract infections associated with the use of a urinary catheter. This is a before-and-after intervention study, carried out in a ten-bed intensive care unit in a high-complexity hospital. Data collection included three moments: pre-intervention, intervention, and post-intervention, carried out between January 2018 and January 2019. In the pre- and post-intervention, an interview was carried out using a structured questionnaire. The intervention took place through a training session with active methodologies and practical demonstrations. There was a trend towards increased knowledge in all items evaluated for the prevention of urinary tract infections associated with the use of a urinary catheter, with significant differences ($p<0.05$) concerning hand hygiene, indications for catheter insertion bladder, barrier measures in the insertion technique, and prevention of this infection during manipulation and maintenance of the bladder catheter. The intervention provided an increase in the knowledge of professionals about prevention measures. However, gaps related to these practices were still being verified and long-term interventions should be conducted with a view to the improvement and safety of care.

Keywords: Urinary Catheters. Catheter-Related Infections. Patient safety. Knowledge. Intensive Care Units.

INTRODUCTION

Catheter-associated urinary tract infection (CAUTI) represents about 40% of healthcare-associated infections (HAIs) and has been related to prolonged hospital stays and, among the main consequences are bacterial resistance, morbidity and mortality, and an increase in healthcare costs[1,2].

CAUTI can be prevented through fundamental principles such as restricted use, according to guideline recommendations; hand hygiene; insertion with aseptic technique; the care in maintaining the catheter; and the strictness regarding the time in which the urinary catheter (UC) remains[2,3,4,5].

To contribute to the prevention and reduction of CAUTI, the Institute for Healthcare Improvement (IHI) developed bundles, which constitute packages of preventive measures that, when collectively performed, improve results compared to the use of iso-

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lated measures[6]. Bundles have been widely disseminated and implemented in hospital institutions and their adoption is considered effective for preventing CAUTI and for improving the quality of services provided[6]. Most bundles for CAUTI prevention are related to UC insertion, maintenance, and manipulation techniques[2,5,6]. However, to be effective the commitment of leaders and the continuous education of the entire multidisciplinary team, through periodic training on techniques and procedures for insertion, maintenance, and removal of urinary catheters is necessary[7,8,9].

Responsibilities for the prevention of CAUTI are generally shared by the medical and nursing staff and, despite the evidence-based control and prevention measures for this infection being clearly defined and recognized, studies still show high incidences of CAUTI, as well as a potential lack of knowledge of professionals concerning such measures, compromising the quality of care provided[10,11,12,13,14,15]. Therefore, changing the attitudes and behaviors of professionals is necessary to improve the practice concerning measures to prevent CAUTI[16,17,18].

National and international guidelines recommend continuing education through service training programs and audits as the gold standard for CAUTI prevention and safer practice[3,8,9], in addition to knowledge assessment, identifying specific aspects that demand greater attention to redirect the practices of health professionals for the prevention of CAUTI[3,4,5]. However, few studies have been carried out on the effects of intervention upon the knowledge of professionals concerning indications to use UC, as well as the measures to prevent CAUTI[17,18,19].

Therefore, the objective of this study was to evaluate the effect of an educational intervention on the knowledge of intensive care professionals concerning measures to prevent urinary tract infections associated with the use of a urinary catheter.

METHODS

Study design and scenario

This is a prospective intervention study, carried out in an Intensive Care Unit (ICU) of a large philanthropic hospital, located in the municipality of Montes Claros, a high complexity reference center in the North of Minas Gerais and South of Bahia, 80% of the consultations are carried out by the Unified Health System (UHS). The hospital has 321 beds, ten of which are clinical ICUs for adult patients.

Participants

The study population consisted of 41 professionals. The sample consisted of medical professionals, nurses, and nurse technicians, responsible for inserting, handling, and maintaining the UC in the ICU. Professionals who were on leave, on vacation, away from activities during the survey, and those who were not found after the third attempt to contact were excluded.

It is noteworthy that in the pre-intervention period there were five refusals, and four professionals were on vacation or sick

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leave, totaling a sample of 32 professionals. In the intervention period, there were five refusals and five professionals on vacation, with a total sample of 31 professionals; and in the post-intervention period, six refusals and another six on vacation/sick leave, totaling 29 professionals. All professionals who participated in the post-intervention period participated in the educational process and answered the same assessment instrument as in the pre-intervention.

Data collection

Data collection was carried out by the researcher herself, from January to December 2018 and took place in a private place, face-to-face, according to the professional's availability and work shift. Data collection included three distinct moments: pre-intervention (January), intervention (June), and post-intervention (December) periods, which are described below.

Pre-intervention: a structured questionnaire was used, designed for the study, divided into two parts: the first consisted of questions about the sociodemographic characteristics of the medical and nursing staff, and the second part was intended for knowledge about the indications for use of a UC; UC insertion technique; preventive measures during handling and maintenance; and multiple measurement strategies (bundle), with all questions based upon the Guideline for Prevention of Catheter-Associated Urinary Tract Infections and Strategies to Prevent Catheter-Associated Urinary Tract Infections in Acute Care Hospitals, and were adapted for the construction of the instrument.

It is noteworthy that there was no differentiation of care activities by professional category, as the medical and nursing staff share responsibilities in relation to the practices of inserting, maintaining, and handling the UC.

Intervention: professionals were invited to attend a training/review/update session on CAUTI prevention measures, in which active methodologies were adopted, with practical demonstrations, playful interventions, and procedure simulation (animated video). This stage took place with the support of the sector's administration, aiming to encourage the greatest possible participation of professionals, in the composition of a group of a maximum of four participants, on dates and times predefined by the unit's supervisors.

Interventions lasted an average of 20 minutes and were developed in different work shifts (morning, afternoon, and night), totaling 14 sessions at different times. In the end, there was an active search for absent professionals and, when necessary, due to difficulties or impediments of the unit's professionals, individual training was carried out, with the aim of guaranteeing training in all stages of the intervention of the entire team that inserted and manipulate a UC.

Post-intervention: an interview was carried out with the same conditions as the pre-intervention period (face-to-face interview conducted by the researcher herself, in a private place according to the availability and work shift of the professional), using the same pre-intervention instrument, with the aim of evaluating the self-reported knowledge of professionals after the educational intervention.

Study variables

This study included variables related to sociodemographic characteristics and professionals' knowledge regarding CAUTI prevention measures, which are described below.

Sociodemographic: Gender (male and female); Age (≤37 and ≥38); Professional category (physician, nurse, and nurse techni-

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cian); Work shift (day and night); and weekly workload (6, 12, 30, and 44 hours).

Knowledge about

Knowledge about indications for the insertion of the urinary catheter: was evaluated based on the questions: "Does the team know about the indications for the insertion of the urinary catheter?". Answer options: Know (yes, no); Adopt (yes, no). Those professionals who answered "yes" were also asked to describe them.

Knowledge about the technique for inserting the urinary catheter: was evaluated based on the question: "Does the team know the technique for inserting a UC?". Response options: Hand hygiene; use of sterile gloves; use of antiseptic solution for hygiene of the urethral meatus; use of single-use lubricating gel; introduce the urinary catheter in an aseptic manner; use of the smallest possible urinary catheter, suitable for drainage; use of a checklist for catheter insertion. All these options had as alternatives "Never; Sometimes; Always; I don't know; Did not answer".

Knowledge about prevention measures: was evaluated based on the question: "Does the team know the measures to prevent urinary tract infection during the manipulation and maintenance of the UC?" Answer options: "yes, no". Those professionals who answered "yes" were also asked: "What are the measures?" and this is an open question.

Data analysis

Knowledge was evaluated by means of the mean and median of the total number of correct answers in the questions referring to CAUTI prevention measures for the indications for the use of a UC, the UC insertion technique, prevention measures during its handling and maintenance, and strategies of multiple measures (bundle). This analysis was stratified by study period: pre- and post-intervention.

When comparing the evaluated periods, Pearson's chi-square test or Fisher's exact test were used for categorical variables. For numerical variables, the non-parametric Mann-Whitney test was used, considering that the analyzed variables did not present a normal distribution. To test normality, the Kolmogorov-Smirnov test was also used. All analyses were performed using the Statistical Package for Social Sciences (SPSS), version 23.0. Results with p-value less than or equal to 0.05 were considered significant.

Ethical aspects

The research was approved by the Research Ethics Committee of the Federal University of Minas Gerais, under opinion number 2.069.140.

RESULTS

In the pre-intervention period, 32 professionals participated, generating an adherence rate of 78%, and in the post-intervention period, there was an adherence of 70.1% with 29 professionals.

The sociodemographic characteristics of the professionals are shown in Table 1. The entire nursing team worked on a 12-hour shift basis, totaling 44 hours a week, and the medical team worked shifts that varied from 6 to 30 hours a week. In the pre-intervention period, in relation to training on the prevention and control of CAUTI in recent years (2016 and 2017), 62.5% of professionals reported

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having participated in training at the institution itself, 85% of which were nurse technicians and 15% nurses (Table 1).

There was no significant increase in the average score of the professionals in all assessments of knowledge about the measures to prevent CAUTI in the post-intervention period (Table 2).

Most participants reported knowing the measures to prevent CAUTI. When inserting the UC, there was an increase in the percentage of correct answers by professionals regarding the indications for inserting a urinary catheter, as well as and the types of and the five moments for hand hygiene according to the World Health Organization (Table 3). It is important to highlight that the professionals mentioned more than one measure and, as it is an open question, no answer option was offered to the interviewees.

The description of self-reported knowledge about CAUTI prevention measures in handling and maintenance is shown in Table 4 and the main results are described below:

There was a difference between the two analyzed periods ($p<0.05$) in the indications for insertion of the UC in patients undergoing urological surgeries, terminally ill patients to provide comfort, and incontinent patients with sacral or perineal ulcers. In all cases, there was an increase after the intervention in the percentage of professionals who reported knowing the barrier measures and technique for inserting the urinary catheter.

The professionals who had better knowledge of the indications for insertion of the urinary catheter after the intervention were physicians (pre-intervention=16.7%; post-intervention=40.8%; p=0.189) and nurses (pre-intervention=8.2%; post-intervention=35.7%; p=0.114). Regarding the insertion technique, an increase in the percentage of correct answers was observed for nurses (pre-intervention=30.8%; post-intervention=38.7%; p=0.886) and nurse technicians (pre-intervention=20. 7%; post-intervention=35.7%; p=0.041), and regarding prevention measures, there was an increase in the percentage in all professional categories, namely: physicians (pre-intervention=31.3%; post-intervention =34.7%; p=0.867), nurses (pre-intervention=50.0%; post-intervention=64.0%; p=0.343), and nurse technicians (pre-intervention=43.3%; post -intervention=54.0%; p=0.460).

With regards to actions preventing infection during handling and maintenance of the UC, 100% of professionals reported that the team had knowledge about this practice.

Of the UTI prevention measures analyzed, there was a significant increase only in the percentage of professionals who reported correct UC fixation (p=0.049) and that the collection bag should be suspended without contact with the floor (p=0.046). The professionals' knowledge regarding the CAUTIU prevention bundle was also verified, with an increase ($p<0.05$) in all variables (Table 5).

When asked to describe the measures that make up this bundle, in the pre-intervention period, only ten professionals (31.2%) claimed to know it and, of these, only four (40%) managed to conceptualize it correctly. In the post-intervention period, 19 (65.5%) professionals were able to describe the measures considered correct. With regards to CAUTI rates, most professionals reported knowing and did not consider it high, but none were able to inform the incidence value.

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Table 1 - Sociodemographic characteristics of the medical and nursing staff at the intensive care unit in the pre- and post-intervention periods. Montes Claros, Minas Gerais, Brazil, 2018-2019.

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
	n (%)	n (%)	
Sex			
Male	18 (56.2)	16 (55.2)	0.933*
Female	14 (43.8)	13 (44.8)	
Age (years)			
≤ 37	16 (50)	18 (62.1)	0.343*
≥ 38	16 (50)	11 (39.3)	
Professional Category			
Physician	8 (25)	7 (25)	0.999†
Nurse	4 (12.5)	4 (14.3)	
Nurse Technician	20 (62.5)	18 (62.1)	
Shift			
Day	19 (59.4)	17 (58.6)	0.952*
Night	13 (40.6)	12 (42.9)	
Weekly workload (hours)			
6	2 (6.3)	1 (3.4)	0.999†
12	4 (12.5)	5 (17.2)	
30	2 (6.2)	1 (1.6)	
44	24 (75)	22 (79.3)	

*Chi-square test; †Fisher's exact test; ICU: intensive care unit.

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Table 2 - Measures of central tendency of self-reported knowledge by professionals about urinary tract infection prevention measures in the insertion, manipulation, and maintenance of the urinary catheter, in the pre- and post-intervention periods. Montes Claros, Minas Gerais, Brazil, 2018-2019.

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
Knowledge about indications for urinary catheter insertion, percentage of correct answers			
Mean	12.5	25.7	
Median	16.7	19.7	
Standard deviation	11.2	23.3	0.122*
Minimum	0	0	
Maximum	33.3	86.0	
Knowledge about the technique of inserting the urinary catheter, percentage of correct answers			
Mean	23.3	26.9	
Median	23.1	24.1	
Standard deviation	10.3	11.2	0.647*
Minimum	7.7	8.2	
Maximum	42.9	63.8	
Knowledge about prevention measures, percentage of correct answers			
Mean	41.1	57.4	0.269*
Median	50	52.9	
Standard deviation	19.4	19.8	
Minimum	0	0	
Maximum	83.3	87.7	

* Mann-Whitney test.

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Table 3 - Self-reported knowledge by professionals about urinary tract infection prevention measures in the insertion of a urinary catheter, as well as the types of and the five moments for hand hygiene according to the World Health Organization, in the pre- and post-intervention periods. Montes Claros, Minas Gerais, Brazil, 2018-2019.

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
The team knows the indications for insertion of the urinary catheter, n (%)			
No	1 (3.1)	1 (3.4)	0.999*
Yes	31 (96.9)	28 (96.6)	
Indications for urinary catheter insertion, n (%)			
Patients with acute urinary retention	19 (59.4)	13 (44.8)	0.310†
Patients undergoing urological surgeries	2 (6.3)	10 (34.5)	0.006*
Long-term surgeries	1 (3.1)	2 (6.9)	0.600*
Terminally ill patients to provide comfort	-	4 (13.8)	0.046*
Surgeries in which diuresis control is necessary	-	1 (3.4)	0.475*
Incontinent patients with sacral or perineal ulcers	1 (3.1)	15 (51.7)	<0.001*
Patients who are expected to spend a long period of immobilization in bed due to trauma	1 (3.1)	5 (17.2)	0.093*
The team knows barrier measures and the technique for inserting the urinary catheter, n (%)			
No	1 (3.1)	1 (3.4)	0.600*
Yes	31 (96.9)	28 (96.6)	
Barrier measures and technique for insertion of the urinary catheter, n (%)			
Sanitization of hands	21 (65.6)	24 (82.8)	0.129†
Use of sterile gloves	23 (71.9)	25 (86.2)	0.172†
Perineal hygiene and antisepsis	25 (78.1)	26 (89.7)	0.307†
Use of single-use lubricating gel	9 (28.1)	11 (37.9)	0.415†
Introduce the urinary catheter aseptically	1 (3.1)	10 (34.5)	0.001*
Use of the smallest caliber catheter possible	1 (3.1)	1 (3.4)	0.999*
Use of a checklist for catheter insertion	-	-	-
The team knows the types of hand hygiene			
No	3 (9.4)	0	0.239*
Yes	29 (90.6)	29 (100)	

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...continuation table 3

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
Types of hand hygiene			
Simple hygiene	25 (78.1)	24 (82.8)	0.649†
Alcoholic friction	23 (71.9)	23 (79.3)	0.501†
Antiseptic cleaning	17 (53.1)	17 (58.6)	0.666†
Surgical antisepsis	9 (28.1)	15 (51.7)	0.060†
The team knows the five moments for hand hygiene			
No	6 (34.4)	6 (20.7)	0.234†
Yes	21 (65.6)	22 (79.3)	
Five moments for hand hygiene			
Before touching the patient	12 (37.5)	19 (65.5)	0.029†
Before aseptic procedure	14 (43.8)	13 (44.8)	0.933†
After risk of contact with fluids	1 (3.1)	6 (20.7)	0.046*
After patient contact	13 (40.6)	18 (62.1)	0.094†
After contact with surfaces	0	12 (41.4)	<0.001*

*Chi-square test; †Fisher's exact test.

Table 4 - Self-reported knowledge by professionals about measures to prevent urinary tract infection during manipulation and maintenance of the urinary catheter, in the pre- and post-intervention periods. Montes Claros (MG), Brazil, 2018-2019.

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
Measures to prevent urinary tract infection during handling and maintenance, n (%)			
Hand hygiene before handling	12 (37.5)	13 (44.8)	0.561†
Hand hygiene after handling	5 (15.6)	8 (27.6)	0.255‡
Use of procedure gloves	6 (18.8)	3 (10.3)	0.478‡
Correct fixation of the urinary catheter	13 (40.6)	19 (65.5)	0.049†
Closed drainage system	4 (12.5)	1 (3.4)	0.357‡
Unobstructed urine stream	1 (3.1)	2 (6.9)	0.600‡
Collecting bag below the level of the bladder	15 (46.9)	13 (44.8)	0.873†
Emptying the collection bag into an individual container	17 (53.1)	14 (48.3)	0.705†

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...continuation table 4

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
Perform disinfection of the connection tube for collection of material for examination	2 (6.3)	-	0.493‡
Suspended collection bag without contact with the floor	1 (3.1)	6 (20.7)	0.046‡
Routine hygiene of the urethral meatus	17 (53.1)	10 (34.5)	0.143†

*Mann-Whitney test; †chi-square test; ‡Fisher's exact test.

Table 5 - Self-reported knowledge by professionals about the bundle and urinary tract infection rates in the pre- and post-intervention periods. Montes Claros, Minas Gerais, Brazil, 2018-2019.

Variable	Pre-intervention (n=32)	Post-intervention (n=29)	*P* value
	n (%)	n (%)	
Correct bundle definition			
No	22 (68.8)	5 (17.2)	<0.001*
Yes	10 (31.2)	24 (82.8)	
The team recognizes bundles as a strategy to prevent urinary tract infections associated with the use of urinary catheters			
No	18 (56.3)	5 (17.2)	0.002*
Yes	14 (43.7)	24 (82.8)	
Using the bundle is effective			
No	13 (40.6)	2 (7.9)	0.002†
Yes	19 (59.4)	27 (93.1)	
Uses the bundle			
No	15 (46.9)	3 (10.3)	0.002†
Yes	17 (53.1)	26 (89.7)	
Knows the rates of urinary tract infection associated with the use of urinary catheters			
No	3 (9.4)	9 (31)	0.034†
Yes	29 (90.6)	20 (69)	

*Chi-square test; †Fisher's exact test.

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DISCUSSION

The results of the present study showed that in the pre-intervention period, the average number of correct answers about the self-reported knowledge of the multidisciplinary team in relation to measures to prevent CAUTI was 12.5% for the indications for inserting a UC and 23.3% for the manipulation and maintenance of the UC. As for hand hygiene, most claimed to know, but were unable to correctly describe the moments and types of hygiene.

Regarding knowledge about the indications for insertion of the UC, acute urinary retention predominated, with no emphasis on the others (patient undergoing urological surgery; patient in need of immobilization due to trauma; terminally ill patient to provide comfort; incontinent patients with ulcers sacral or perineal; long-term surgery; and surgery in which diuresis control is necessary), and the professionals who demonstrated the best knowledge were physicians. In a similar study carried out in India, physicians' knowledge of recommendations for using the UC was significantly better compared to nurses, since they are responsible for the decision to use the UC[16]. Despite the important role of the care team in UC management, studies indicate a level of knowledge close to 50% of compliance for UC indications in different clinical scenarios, suggesting that both nurses and medical staff are using UC unnecessarily[16,20,21].

The main undue indications for UC use reported by professionals in this study were for critically ill patients and for those performing a fluid balance. In these cases, the insertion of the UC should always be questioned regarding the possibilities of being replaced by an alternative method, such as the use of parrots, bedpans, condoms, and even intermittent bladder catheterization[3,8,9,22]. These methods are generally not adopted, due to the false idea of professionals that critically ill patients should use a UC and due to the convenience of the team, as they apply this care for critically ill and incontinent patients, especially when there is work overload[3,9,22].

In terms of knowledge about the UC insertion technique, there was less knowledge of the professionals in relation to the following aspects: introducing the catheter in an aseptic manner, using the smallest possible caliber catheter, and a checklist for insertion. Once the insertion of the UC is indicated, the planning of the aseptic technique and the organization of materials and equipment must be carried out to avoid possible failures that put patient safety at risk[3,9,23,24,25]. The procedure requires knowledge, and only a trained professional, who masters the correct technique for inserting the catheter, is recognized by the Federal Nursing Council (FNC) as a specific procedure for nurses[3,7,8,9].

With regards to knowledge about CAUTI prevention measures during UC handling and maintenance, gaps were observed in all prevention actions. Knowledge of all the recommendations for the prevention of CAUTI is fundamental and represents a great impetus for the adequate use of the UC[17,23]. Studies point out that multiple interventions, such as on-site education/training of personnel, video sessions, and electronic reminders, have a positive impact on knowledge and consequent reduction in the rates of CAUTI[2,23,24,25].

Concerning knowledge about CAUTI rates in the unit, no professional was able to

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inform the approximate value of the incidence density. This finding is worrisome and leads one to think that professionals do not have information about the occurrence of CAUTI in the sector or do not recognize it as an aggravation with potential morbidity and mortality[23].Thus, the lack of attention to the occurrence of CAUTI represents an important gap for the practice of prevention, since identifying and acknowledging that CAUTI rates are problems in the unit are the first steps towards successful interventions[26-27].

In the post-intervention period, there was an increase in all items evaluated for the prevention of CAUTI. However, significant differences were found in the two analyzed periods, namely: description of moments for hand hygiene, indications for insertion of the UC, adherence to the barrier measure in the insertion technique, and measures to prevent CAUTI during manipulation and UC maintenance.

Regarding the indications for inserting the CV, this study did not show a significant difference in the professionals' knowledge in the analyzed periods. In the post-intervention period, all indications were cited by professionals with a significant increase: those undergoing urological surgery, the terminally ill to provide comfort, and those who are incontinent with sacral or perineal ulcers, in accordance with guideline recommendations. The most important preventive measure to reduce the incidence of CAUTI provided for in the various guidelines refers to limiting the use of a UC, and this is only possible with adequate knowledge of professionals about its indications, as subjectivity contributes to unnecessary use and prolonged periods, which has repercussions on high rates of CAUTI[5,9,16]. Thus, it is up to each institution to adopt the explicit guidelines and criteria, based on evidence and recommendations by national and international organizations, associations and societies, for insertion and maintenance of a UC, with indications widely accepted by the multidisciplinary team, according to the needs of the care unit and which should be made available through clinical protocols[3,9,22].

As for CAUTI prevention measures during handling and maintenance of the UC, the professionals presented the same gaps verified in the pre-intervention period: low self-reported knowledge for the main recommendations of the guideline, except for the item fixing the UC and suspended collection bag having no contact with the floor. Similar results were found in a study carried out in the ICU of a public hospital in Bahia, in which professionals were unaware of the bundle's main CAUTI prevention actions[18]. These findings reinforce the need, above all, to act in a multidisciplinary and interdepartmental way, understanding that CAUTI is a care problem. The professionals responsible for surveillance must act in the units in an integrated manner, disclosing indicators, team performance, and consolidating practices that may constitute daily gaps between professionals. Whether this is due to a lack of knowledge, negligence, or disregard of the steps to prevent infections in insertion, handling, or maintenance of the UC, these practices should always be supported by a consolidated safety culture in the institution, where the reduction of adverse events is an institutional goal. However, for this to occur, theoretical and technical knowledge aligned with the risk factors and preventive measures for CAUTI is necessary, leading to changes in care practices, in order to qualify the care and minimize the risk of iatrogenesis[21,25].

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Regarding the knowledge of professionals about hand hygiene, the results agree with a study carried out in a university hospital, which found that 56.7% of professionals claimed to know the five moments of hand hygiene. However, of these, only 8.1% were able to correctly describe the referred moments[10]. Other studies also concluded that the knowledge of health professionals about hand hygiene is limited and remains an important challenge1[1,12]. Although professionals recognize hand hygiene as essential for the prevention of HAI, knowledge of this practice is far from the recommendations of national and international guidelines[11,13,14,15]. Intervention studies have been carried out to improve the knowledge and practice of the health team on hand hygiene[13,14,25]. In a survey carried out in Finland, after a single educational session, the professionals' knowledge was evaluated in three moments during a 2-year period, and there was no change over time[13]. In an intervention carried out with nurses from a hemodialysis unit, after two training sessions, there was no significant effect on knowledge about hand hygiene among participants[25]. On the other hand, daily intervention, using electronic methods to distribute audio messages on hand hygiene to health professionals in an ICU in Iran, for 3 months, significantly increased ($p<0.001$) these professionals' knowledge about this practice[14]. Thus, it is clear that a one-time intervention may not reflect changes in the professionals' knowledge, requiring frequency and long-term continuity, in addition to encouraging active involvement in the learning process[26,27,28,29,30].

Regarding the limitations, it can be highlighted that the study was carried out in a single institution, which does not allow for the extrapolation of the results. However, it demonstrates a reality of a large philanthropic hospital that can be similar to other locations. There is also the fact that the intervention was carried out at just one moment with an infrequent evaluation of the intervention, but even so, this study highlighted necessary improvements in the knowledge of professionals, reinforcing the idea that training should be continued.

CONCLUSION

The educational intervention results suggest improved knowledge of professionals in some prevention measures (description of the five moments for hand hygiene, indications for inserting the UC, barrier measures for aseptic insertion technique, and measures to prevent CAUTI during manipulation and UC maintenance). However, gaps were still identified in relation to the insertion technique and measures to prevent CAUTI. Thus, it is necessary that professionals not only know, but have the ability and attitude to adopt all measures properly, considering that knowledge alone is not enough to guarantee improvement in the care provided.

Further investigations must be carried out with ongoing interventions, to assess not only the immediate impact, but the sustainability of good practices over time.

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Author Statement CRediT

Conceptualization: Mota, EC; Oliveira, AC. Methodology: Mota, EC; Oliveira, AC. Validation: Mota, EC; Oliveira, AC. Statistical analysis: Mota, EC; Oliveira, AC. Formal analysis: Mota, EC; Oliveira, AC. Research: Mota, EC; Oliveira, AC. Resources: Mota, EC; Oliveira, AC. Writing-preparation of the original draft: Mota, EC; Oliveira, AC. Writing-revision and editing: Mota, EC; Oliveira, AC. Visualization: Mota, EC; Oliveira, AC. Orientation: Oliveira, AC. Project management: Mota, EC; Oliveira, AC.

All authors read and agreed with the published version of the manuscript.

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Received: 24 february 2022.
Accepted: 10 march 2023.
Published: 10 august 2023